

Use of the Dental Disease Nonbattle Injury Encounter Module to Assess the Emergency Rate on an Army Military Installation Within the United States

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ABSTRACT The objectives of this study are (1) to establish a baseline rate for dental emergencies (DE) occurring within a Brigade Combat Team (BCT) garrisoned on a military installation located in the continental United States (CONUS), and (2) to determine if differences in risk of DE are observed in soldiers of different Dental Fitness Classifications (DFC). Data concerning DE were documented by Army Dental Corps providers using CONUS Dental Disease Nonbattle Injury Emergency Encounter module of the Corporate Dental Application (CDA). The data were collected from September 1, 2011 to December 15, 2011. The number of soldiers at risk, the BCT dental readiness, the DFC of each soldier who experienced a DE, and the date of the dental visit that preceded the DE were documented from CDA. The estimated rate of 221 DE per 1,000 soldiers per year was observed. The risk of DE for DFC 3 soldiers was five times that of soldiers who were DFC 1 or 2. Assessing the DE rate of a BCT in garrison is useful for stakeholders and policymakers who must accommodate the impact of DE on mission readiness.

INTRODUCTION

Throughout history, it has been documented that disease and nonbattle injuries (DNBIs) have caused more casualties than combat actions, and have threatened the combat effectiveness of many units.¹ Dental emergencies (DE) caused by DNBIs have been documented as being a threat to effective combat power.² Documenting dental disease and nonbattle injuries (D-DNBIs), as it relates to combat effectiveness, is paramount in understanding what occurs with the oral health of soldiers during deployments. The vast majority of documented D-DNBIs are obtained through DE data collection. A report by McKee et al³ has indicated that 10% of a deployed unit sick call experiences was because of dental related issues. Murray et al⁴ reported that 19% of 4,831 soldiers in a brigade had dental issues and sought care at a dental treatment facility (DTF) while deployed. Furthermore, Payne and Posey⁵ reported a rate of 167 DE per 1,000 soldier per year. Deutsch and Simecek⁶ reported an annual rate of 149 DE per 1,000 U.S. Marines deployed to Desert Shield/Storm. In comparison, Swan and Karpetz⁷ reported an annual rate of 232 DE per 1,000 Canadian soldiers who were deployed

to Somalia. However, a literature review by Mahoney and Coombs⁸ concluded that a well-prepared, dentally fit force can expect 150 to 200 dental casualties per 1,000 personnel per year. The authors further stated that with a less dentally fit force, the DE rates would be higher. It is quite evident and fully established that DE can directly influence the combat effectiveness of a unit.² A diminished fighting force, as a result of DE, can leave a unit incapable of completing its military mission.

The U.S. Army readily recognizes the importance of proper oral care and dental readiness of all its soldiers. Notwithstanding, the responsibility of the U.S. Army Dental Corps is to provide a dentally fit force that supports Full Spectrum Operations and provides Warrior-focused oral health care for all soldiers. Therefore, the Department of Defense (DoD) Dental Classification system⁹ is used to identify and prioritize dental treatment for soldiers who are at a higher risk of becoming a casualty because of dental conditions.¹⁰ The Dental Fitness Class (DFC) categories are defined as follows: DFC 1—Patients with a current dental examination, who do not require dental treatment or re-evaluation—DFC 1 patients are worldwide deployable; DFC 2—Patients with a current dental examination, who require nonurgent dental treatment or re-evaluation for oral conditions, which are unlikely to result in DE within 12 months—DFC 2 are considered to be worldwide deployable; DFC 3—Patients who require urgent or emergent dental treatment—DFC 3 patients normally are not considered to be worldwide deployable; DFC 4—Patients who require periodic dental examinations or patients with unknown dental classifications—DFC 4 patients normally are not considered to be worldwide deployable.

Even though the DE rates of deployed soldiers are well documented, the emergency rates for soldiers within the

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Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 01 SEP 2015		2. REPORT TYPE N/A		3. DATES COVERED -	
4. TITLE AND SUBTITLE Use of the dental disease nonbattle injury encounter module to assess the emergency rate on an Army military installation within the United States				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) Colthirst P., DeNicolo P., Will R., Simecek J. W.,				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) United States Army Institute of Surgical Research, JBSA Fort Sam Houston, TX				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release, distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT UU	18. NUMBER OF PAGES 6	19a. NAME OF RESPONSIBLE PERSON
a REPORT unclassified	b ABSTRACT unclassified	c THIS PAGE unclassified			

Continental United States (CONUS) are not. Because of the austere environmental conditions of the battlefield and limited accessibility to dental care, the authors hypothesized that CONUS DE rate would be lower than the rate of deployed soldiers. However, with no comparison data, this it is difficult to verify. On the other hand, there are those who argue to the contrary, citing the fact that nondeployed soldiers will indeed have a higher risk of DE because they receive less scrutiny of treatment needs than those scheduled to deploy or have deployed, or they experienced many postoperative DE because of treatment rendered to achieve operational readiness.

It is imperative to collect accurate data to provide credible information to dental commanders in order that the necessary dental resources can be allocated during deployments. In 2005, the commander of the 502d Dental Company Area Support used the Army Dental Command Corporate Dental Application (CDA) to capture D-DNBI in Iraq.¹¹ The D-DNBI Emergency Encounter module (DEE) had been developed and attached to CDA since 2009. The DEE module appears whenever the code for DE (A0199) was included in the workload data entry that is documented by providers. Eikenberg et al¹¹ realized that the lack of uniform theater policy for using the DEE module was a hindrance to capturing accurate and complete data for emergency rates. The 502d and Task Force 1st Medical Brigade established a policy that made it mandatory for providers in theater to report all patient encounters within the CDA. The new policy encouraged each provider to select A0199 for each patient when presented with a DE, thus populating the first generation DEE encounter module.¹¹ Eventually, the Multi-National Corps-Iraq adopted the policy theater wide. An audit was conducted on every entry into CDA within 48 hours of each patient encounter to ensure compliance and accuracy of the data being entered. Even though the data collection was complete and accurate, several additional improvements to the DEE module were introduced in 2011.

The purposes of this study were to utilize a redesigned DEE module in order to: (1) assess the rate of DE and (2) determine risk differences among the DFCs on a nondeployable brigade on a military installation in the United States.

METHODS AND MATERIALS

A Brigade Combat Team (BCT) was identified at a local CONUS military installation. The criteria for choosing this BCT were: (1) this unit would not be deploying for at least a year, (2) this unit had already returned from deployment and is now dentally reset, (3) the unit mimics that of other similar sized BCT currently in theater, and (4) all the dental work of the soldiers attached to the BCT would have to be done at the same DTF. Once the BCT was selected, all clinic personnel at the DTF were provided information concerning the definition of DE, as well as training on documenting DE cases within CDA.

When a patient presents to the dental clinic as a DE, an A0199 for emergencies or A0140 code for problem-focused

areas is given. These codes populate the DEE module, which is then filled out by the provider. The DEE module is currently attached to the CDA, which is a workload application that allows dental providers to record treatment, treatment needs, caries risk, and tobacco use. A DE is defined as a condition of oral disease, trauma or loss of function, or other concern that causes a patient to seek immediate dental treatment.¹²

Each DEE module requires providers to document a unique set of variables. These variables include: identification number (ID), gender, DFC after emergency treatment, reason for seeking treatment (patient perspective), difficulties caused by the oral problem, tooth number involved, etiology of the oral problem (provider perspective), and patient disposition. The additional questions that were added to the DEE module in 2011 appear in the etiology section. The type of restorative material (amalgam, composite, temporary) was added to accurately identify restoration failure, with and without caries involvement. The fractured tooth or restoration with or without caries was also augmented with material identification; however, it was differentiated by one additional question of "no restoration present." The etiologies of pulpal conditions that may be influenced by restorative material were also enhanced to include the type of material used for restoration. The disposition category received one additional question to determine if the patient was referred for advanced or specialty treatment.

In addition to the redesigned DEE module, a spreadsheet was created that included the patient ID number; the last date of exam received; the last dental DFC at the time of the exam; prior exam date; prior treatment DFC; gender, emergency encounter date; tooth number; and etiology of DE. All the information can be gleaned and imported into the spreadsheet directly from the DEE module. Additional clinical information that included: (1) last exam date, (2) exam DFC, (3) prior treatment date, (4) prior treatment DFC, and (5) number of soldiers in each DFC was obtained from CDA.

To limit distribution of sensitive information including patient identifiers, the data management plan required replacing patient identifiers with an internally generated unique ID, which equally identifies a unique person but will alleviate the need to use patient identifiers. The Statistical Analysis System version 9.2 software was used to generate the frequencies and relative risk. Probability of Type 1 error was set at 0.05.

This study was conducted under a protocol reviewed and approved by the U.S. Army Medical Research and Materiel Command Institutional Review Board and in accordance with the approved protocol office (USAISR Protocol No: H-11-037).

RESULTS

A total of 3,940 soldiers were assigned to the BCT. During the 3½ months (105 days) of data collection, 255 DE were documented. The estimated annual rate of DE was calculated

TABLE I. Frequency and Percentage of Dental Emergencies by Diagnosis

Diagnosis	Frequency	Percent
Tooth, Caries, Restoration Related	93	36%
Dentoalveolar (Third Molar)	83	33%
Pulpal	44	17%
Periodontal	18	8%
Trauma and Other Dental Conditions	17	6%
Total	255	100%

as 221 per 1,000 soldiers. The distribution by etiology showed that enamel (36%), dentoalveolar (33%), and pulpal (17%) problems attributed the majority of DE (Table I).

Of all DE problems having a tooth-, restoration-, or caries-related etiology, hyperocclusion (15%) had the highest frequency, followed by defective/missing amalgam restorations because of caries (11%), and fractured amalgam restorations without caries involvement (11%) (Table II). The overall frequency of enamel problems was 93 encounters (36% of total DE).

Alveolar osteitis (31%) attributed to the majority of dentoalveolar complaints. This was followed by pericoronitis

TABLE II. Frequency and Percentage of Tooth-Related Dental Emergencies

Diagnosis (Enamel)	Frequency	Percent
Tooth or Restoration in Hyperocclusion	14	15%
Defective/Missing Amalgam Restoration (Caries)	10	11%
Fractured Tooth/Amalgam Restoration (No Caries)	10	11%
Dental Hypersensitivity	10	11%
Dental Caries	8	9%
Defective/Missing Amalgam Restoration (No Caries)	6	6%
Fractured Tooth/Restoration (No Caries)	6	6%
Fractured Tooth/Composite Restoration (Caries)	5	5%
Defective/Missing Composite Restoration (No Caries)	4	4%
Fractured Tooth/Amalgam Restoration (Caries)	3	3%
Fractured Tooth Without Restoration (Caries)	3	3%
Defective/Missing Temporary Restoration (No Caries)	3	3%
FX Rest(No Caries)	3	3%
Other Tooth-Related Problem	2	2%
Defective/Missing Composite Restoration (Caries)	1	1%
Defective/Missing Temporary Restoration (Caries)	1	1%
Fractured Tooth/Temporary Restoration (Caries)	1	1%
Defective/Missing Restoration (No Caries)	1	1%
Fractured Tooth/Composite Restoration (No Caries)	1	1%
Fractured Tooth/Temporary Restoration (No Caries)	1	1%
Total	93	100%

TABLE III. Frequency and Percentage of Third-Molar-Related Dental Emergencies

Diagnosis (Dentoalveolar)	Frequency	Percent
Alveolar Osteitis	26	31%
Pericoronitis	21	25%
Eruption Pain	13	16%
Other Dentoalveolar Problem (Third-Molar Related)	9	11%
Sequestrum	5	6%
Anatomic Space Infection (Third-Molar Related)	4	5%
TMJ Problem	3	4%
Hemorrhage	2	2%
Total	83	100%

(25%), eruption pain (16%), and other nonspecified third-molar-related problems (11%) (Table III). The overall frequency of dentoalveolar or third-molar-related problems was 83 encounters (32% of total DE).

Pulpitis in teeth with amalgam restorations attributed to the greatest number of pulpal emergencies (16 DE; 36% of pulpal DE). Pulpless/previously treated teeth were second with 10 reported cases (23%) and pulpitis without any restoration attributed (9%) (Table IV). The frequency of pulpal problems was 44 (17% of total DE).

Gingivitis was the most frequent periodontal-related DE with 10 (56%) DE documented during the reporting period (Table V). The frequency of periodontal problems was 18 (8% of total DE). Also the number of DE as a result of trauma was relatively small. Only 4 (1%) DE were documented as having been caused by external trauma (Table VI).

Of the 3,940 soldiers in the BCT, 134 were DFC 3 or DFC 4, of which 39 (29.1%) had a DE, while 3,806 were DFC 1 or DFC 2 of which 216 (5.7%) had a DE. The risk of having a DE for nondeployable soldiers (DFC 3 or 4) was five times greater than that of soldiers of DFC 1 or DFC 2 (Relative Risk = 5.13; 95% Confidence Interval (3.82–6.88). The risk ratio confirms that a soldier in DFC 3 or DFC 4 has

TABLE IV. Frequency and Percentage of Pulpal-Related Dental Emergencies

Diagnosis (Pulpal)	Frequency	Percent
Pulpitis in Tooth With Amalgam Restoration	16	36%
Pulpless/Previously Treated Tooth	10	23%
Pulpitis	4	9%
Necrotic Pulp in Tooth With Amalgam Restoration	4	9%
Necrotic Pulp in Tooth With Temporary Restoration	3	7%
Pulpitis With Temporary Restoration	2	5%
Necrotic Pulp in Tooth With Composite Restoration	2	5%
Pulpitis in Tooth With Composite Restoration	1	2%
Periradicular Periodontitis	1	2%
Other Pulpal/Endodontic Problem	1	2%
Total	44	100%

TABLE V. Frequency and Percentage of Periodontal-Related Dental Emergencies

Diagnosis (Periodontal)	Frequency	Percent
Gingivitis/Gingival Bleeding	10	56
Periodontal Abscess	3	17
Ailing/Failing Implant	2	11
Other Periodontal/Gingival Problem	2	11
Necrotizing Ulcerative Gingivitis	1	5
Total	18	100

TABLE VI. Frequency and Percentage of External Trauma and Other Dental Emergencies

Diagnosis (External Trauma and Other)	Frequency	Percent
Defective or Broken Prosthesis, Provisional	4	24%
Fractured Tooth or Teeth (Trauma Related)	3	18%
Aphthous Ulcer	2	12%
Defective or Broken Prosthesis, Permanent	2	12%
Other Oral or Dental Condition	2	12%
Fractured Facial Bones (Trauma Related)	1	6%
Partially Avulsed Tooth or Teeth (Trauma Related)	1	6%
Totally Avulsed Tooth or Teeth (Trauma Related)	1	6%
Other Trauma-Related Problem	1	6%
Total	17	100%

a much greater risk of DE when compared to soldiers in DFC 1 or DFC 2.

DISCUSSION

Within CONUS, and more specifically, within a garrison setting, comprehensive dental care treatment is provided to soldiers. However, minimal comprehensive care is available during deployments. At the brigade level, oral care is limited and only includes emergency or essential treatment in the theater of operations.¹³ The results of this study indicate that of the top five aforementioned etiologies by frequency, three were because of postoperative problems, i.e., hyperocclusion, alveolar osteitis, and pulpitis because of amalgam restorations. We can, however, safely say that the evaluation of the placement and masticatory functionality of recently placed restorative materials and postoperative instructions with respect to alveolar osteitis is very important to decrease the number of these problems.

Assessing the DE rate in CONUS using the redesigned DEE module is a significant advancement toward understanding the overall DE treatment needs within the Army. The addition of available descriptions of DE highlights the level to which information can be gathered. The ability to document the many reasons why a patient presents with an emergency, at the tooth level, has not been available up to this time. The findings from this study suggest that CONUS soldiers have a higher DE rate than historical data might suggest of deployed soldiers.^{2,6} This finding may appear alarming; however, Mahoney and Coombs⁸ reported that

DE rates have been lower in populations with high levels of readiness, i.e., deploying soldiers. One explanation for this result is that soldiers who are being deployed are given priority of care over soldiers who are not deploying. Therefore, soldiers who are deploying are at a high level of dental readiness.

Another explanation for a greater DNBI rate in CONUS is that CONUS soldiers have greater access to dental care and therefore utilize dental services at a higher rate than deployed soldiers. Many of the DE observed, such as alveolar osteitis and hyperocclusion are postoperative sequelae that increase in garrison because of predeployment treatment. The fact that soldiers do not have to pay out-of-pocket expenses to consult with a dental provider, allows them the flexibility to present to the DTF at any time without an appointment as a DE. Similarly, deployed soldiers have the opportunity to visit a DTF; however, there are increased associated costs to this decision, such as in theater transportation, decreased combat power of the soldier's unit, and logistical coordination and considerations.

Another fact that could have influenced the higher rate in garrison is the amount of need found in young soldiers. The majority of a BCT is comprised of young enlisted soldiers many of whom are first termers, which indicate that they are within their first enlistment and perhaps in their first unit assignment. It is conceivable to think that some of these soldiers are being assigned to BCTs immediately after completing their Advance Individual Training requirements. If this is indeed the case, the 2008 DoD Recruit study¹⁴ reports that more than half of all 2008 regular Army recruits (53.7%) were classified as DFC 3, which indicates a considerable quantity of severe dental problems that require treatment. In contrast, soldiers who have deployed have already received their dental treatment before deploying and are in better oral health than the average recruit.

Even though every attempt was made to ensure that the data were accurate, there are limitations to the study. Allowing the patient to dictate what constitutes a DE primarily based on sensitivity or pain is highly subjective and will invariably differ among patients. Additionally, the overall affect of increased reporting of DE, using the DEE module, may result in higher rates. To ensure accuracy in assessing DE, diagnostic codes should be utilized and dental providers should determine whether the encounter is truly a DE using strict guidelines. Finally, the length of the study is also a limiting factor. The data were captured over a 3-month period. It however must be noted that the numbers of DE visits were consistent across each week with a range of 14 to 17 emergency patients per week.

These data can be used to develop and field a Daily Dental Emergency Calculator (DDEC). Using the DE risk calculated for each DFC to estimate the number of DE based on actual BCT readiness statistics, a more accurate estimation of deployed D-DNBI can be obtained. These estimates can be used by medical and dental planners to determine the number

of DE they will encounter during a specific period of time. The information gathered from the DDEC can be used to efficiently manage resources across the various commands and to reduce costs and patient suffering.

CONCLUSION

Dental providers are trained to assess soldier's oral conditions by means of a periodic or comprehensive oral examination. Conducting thorough oral exams is pivotal to the accurate documentation of dental readiness. The data from this study confirm the effectiveness of the DFC systems in assigning risk of DE on a population basis. Knowing the DE rate of a BCT in CONUS is imperative in order to compare with historical DE rates of deployed soldiers. Understanding the distribution of types of DE, and the impact it has on dental resources both in CONUS and in theater, is valuable information for stakeholders and policymakers. The current rate of 221 DE per 1,000 soldiers per year is higher than historical DE rates of deployed soldiers. Using the redesigned DEE module gives providers, dental researchers, and Commanders the ability to quickly assess the types of DEs a unit is experiencing and recommend possible pretreatment modalities to alleviate or decrease the incidence of future emergencies. Additional standardized studies are warranted in this area with the categorization and documentation of the types and severity of DE.

ACKNOWLEDGMENTS

The authors thank the staff of the Center for Army Medical Department Strategic Studies for their superb level of professionalism and analysis. This study was funded by the United States Army Institute of Surgical Research (Protocol No. H-11-037).

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